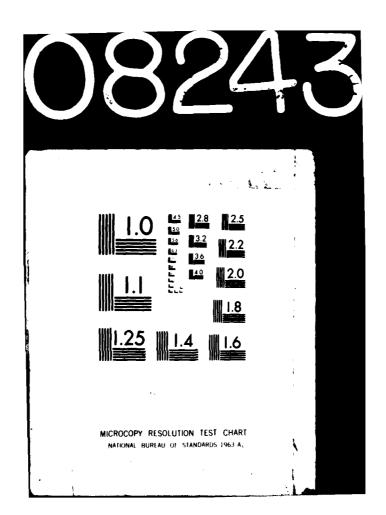
TENNESSEE STATE DEPT OF CONSERVATION NASHVILLE DIV 0--ETC F/G 13/13 NATIONAL PROGRAM OF INSPECTION OF NON-FEDERAL DAMS, TENNESSEE. --ETC(U) JUN 81 W H CULBER BLOOD DAY BE ABLE-COLOR AD-A108 243 DACW62-81-C-0056 UNCLASSIFIED NL 







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REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM		
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Macon County, TN., Barren River Basin	PERFORMING ONG. REPORT NUMBER		
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)			
Dams	Macon County, TN		
Dam Safety	Embankments Visual Inspection		
National Dam Safety Red Boiling Springs Dam No. 1, TN.	Structural Analysis		
Red Roiling Springs, TN			
2). ABSTRACT (Continue on reverse side it necessary and identity by block number) The dam is a linear earthen structure 450' long and 47.5 high with a crest width of 18'. The upstream and downstream slopes are 3.2H: IV and 3.0H: IV respectively. The surface area of the lake is 5.4 acres at normal pool and 15.5 acres at the top of the dam. On the day of the inspection the reservoir was about 2/3 full for the first filling since construction. At the left abutment is an uncontrolled earth and rock saddle spillway with a base width of 72'.			
The principal spillway consists of a 2.5' x 7.5' reinforced concrete riser			
feeding a 30" steel cylinder concrete pipe. The drawdown is a 74" formed			
feeding a 30" steel cylinder concrete nine The d			

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# DEPARTMENT OF THE ARMY NASHVILLE DISTRICT, CORPS OF ENGINEERS P. O. BOX 1070 NASHVILLE, TENNESSEE 27202

... ....

9 JUN 1981

ORNED-G

Honorable Lamar Alexander Governor of Tennessee Nashville, TN 37219

Dear Governor Alexander:

Furnished herewith is the Phase I Investigation Report on Red Boiling Springs Dam No. 1 near Red Boiling Springs, Tennessee. The report was prepared under the authority and provisions of PL 92-367, the National Dam Inspection Act, dated 8 August 1972.

The report presents details of the field inspection, background information, technical analyses, findings, and recommendations for improving the condition of the dam.

Based upon the inspection and subsequent evaluation, this dam is classified as not deficient having no apparent deficiencies relative to its safety. The dam, classified as high hazard, has sufficient spillway capacity to pass the full probable maximum flood.

Public release of the report and initiation of public statements fall within your prerogative. However, under provisions of the Freedom of Information Act, the Corps of Engineers is required to respond fully to inquiries on information contained in the report and to make it accessible for review on request.

Your assistance in keeping me informed of any further developments will be appreciated.

l Incl

As Stated

CF:

Mr. Robert A. Hunt, Director Division of Water Resources 4721 Trousdale Drive Nashville, TN 37220 ),

Stacerely,

LEE W. TUCKER

Colonel, Corps of Engineers

Commander

### PHASE I REPORT NATIONAL DAM SAFETY PROGRAM TENNESSEE

Name of Dam	Red Boiling Springs Dam No. 1
County	Macon
Stream Tributary of Sal	t Lick Creek at Witcher Hollow
Date of Inspection	January 8, 1981
	luation was prepared by the nservation, Division of Water
PREPARED BY:	William Culbert, Jr. Water Resources Engineer
APPROVED BY:	Edmond O'Neill Chief Engineer Safe Dams Section

APPROVED BY:

Robert A. Hunt, P.E. Director, Division of Water Resources

Tennessee Department of

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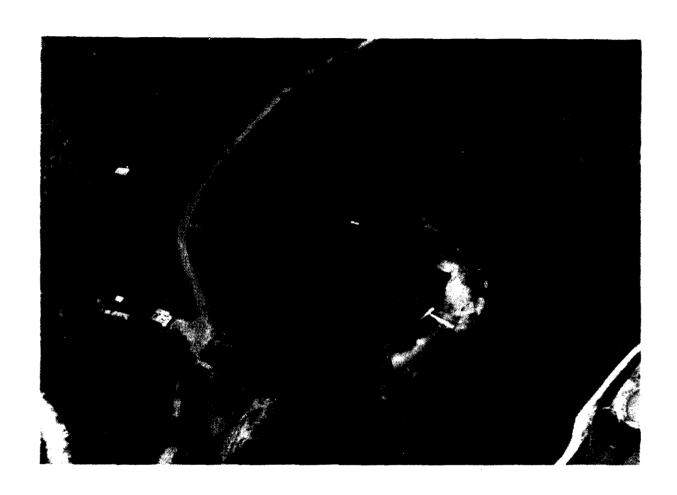
#### PREFACE

This report is prepared under guidance contained in the Department of the Army, Office of the Chief of Engineers, Recommended Guidelines for Safety Inspection of Dams, for a Phase I investigation. The purpose of the Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In the review of this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. Additional data or data furnished containing incorrect information could alter the findings of this report. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structures and may obscure certain conditions which might be detectable if inspected under the normal operating environment of the structure.

The analyses and recommendations included in this report are related to the hazard classification of the structure at the time of the report. Changes in conditions downstream of the dam may change the hazard classification of the structure. A change in hazard classification may in turn change the design flood on which the hydraulic and hydrologic analyses are based and may have a significant impact on the assessment of the safety of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions and is evolutionary in nature. It would be incorrect to assume that the present conditions of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspections can there be any chance that unsafe conditions will be detected.



Red Boiling Springs Dam No. 1

Macon County

April 2, 1981

#### PHASE I INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM TENNESSEE

Name of Dam	Red Boiling Springs Dam # 1 Macon
Stream	Tributary of Salt Lick Creek at Witcher Hollow
Date of Inspection	

#### ABSTRACT |

The dam is a linear earthen structure 450' long and 47.5' high with a crest width of 18'. The upstream and downstream slopes are 3.2H:1V and 3.0H:1V respectively. The surface area of the lake is 5.4 acres at normal pool and 15.5 acres at the top of the dam. On the day of the inspection the reservoir was about 2/3 full for the first filling since construction.

At the left abutment is an uncontrolled earth and rock saddle spillway with a base width of 72'. The principal spillway consists of a 2.5' x 7.5' reinforced concrete riser feeding a 30" steel cylinder concrete pipe. The drawdown is a 24" formed opening at the upstream toe of the riser regulated by a manually operated 24" sliding headgate.

The embankment is uniform and well grassed with no signs of cracking, sliding, or differential settlement observed on the embankment or in the area immediately downstream. There are no trees or other deleterious vegetative growth.

The dam is in the intermediate size and high hazard potential category. On the basis of these classifications, the structure is required to pass the full probable maximum flood (PMF) of 28.2" of rain falling in 6 hours. Analysis reveals that the spillway is capable of passing the flood without causing the dam to overtop.

Since the dam has no significant defects or inadequacies, it is considered to be "not deficient". Operation and maintenance procedures should be continued as usual.

PHASE I INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM RED BOILING SPRINGS DAM NO. 1 MACON COUNTY, TENNESSEE

# SECTION 1 - GENERAL

- 1.1 Authority The Phase I inspection of this dam was carried out under the authority of Tennessee Code Annotated, Section 70-2501 to 70-2530, "The Safe Dams Act of 1973", and in cooperation with the U. S. Army Corps of Engineers under the authority of Public Law 92-367, "The National Dam Inspection Act".
- 1.2 Purpose and Scope The purpose of a Phase I investigation is to develop an engineering assessment of the general condition of a dam with respect to safety and stability. This is accomplished by conducting a visual inspection, reviewing any available design and construction data, and performing appropriate hydraulic, hydrologic, and other analyses. A comprehensive description of the Phase I investigation program is given in Recommended Guidelines for Safety Inspection of Dams, by the Department of the Army, Chief of Engineers, Washington, D. C. 20314.
- Past Inspections Personnel from the Tennessee
  Department of Conservation, Division of Water
  Resources, surveyed the dam and conducted a cursory
  inspection of the site on December 30, 1980. The
  dam is inspected at least annually by SCS to provide
  maintenance recommendations for the Watershed
  District Board.
- 1.4 <u>Details of Inspection</u> The Phase I inspection was conducted on January 8, 1981. The weather was partly cloudy and 25°F. There were scattered patches of snow on the ground but the embankment was relatively clear. The reservoir was approximately 7' below normal pool elevation 871.5' msl.
- 1.5 <u>Inspection Team Members</u> The inspection was conducted by the following State personnel:

Edmond O'Neill Robert Ramsey William Culbert, Jr.

The team was accompanied by Albert Dunn (Corps of Engineers) and Paul Goforth, Project Engineer (SCS).

#### SECTION 2 - PROJECT DESCRIPTION

- 2.1 Location Red Boiling Springs Dam # 1 is located in Macon County, Tennessee, 1.6 miles east of Red Boiling Springs in Witcher Hollow on an unnamed tributary of Salt Lick Creek. The site is shown on the 7.5 minute Red Boiling Springs U. S. Geological Survey map 320 SE at latitude 36 31'52" N and longitude 85°49'20" W. Location maps are provided in Appendix B of this report.
- 2.2 History of Project The project was sponsored by the City of Red Boiling Springs and the Macon and Clay County Soil Conservation Districts as a flood control dam. It was completed on October 12, 1979, by Pat Eatherly Construction firm of Carthage, Tennessee. Design was by the Soil Conservation Service under Public Law 566, the Watershed Protection and Flood Prevention Act. The site is owned by the city of Red Boiling Springs and the city is also responsible for all protection, maintenance, and operating procedures.
- 2.3 Size and Hazard Classification Based on a structural height of 47.5 feet and a maximum storage capacity of 241 acre-feet, the dam is considered to be of intermediate size. According to the OCE guidelines, the structure falls into the high hazard potential category because several homes lie downstream of the dam in the probable flood path.
- 2.4 Description of Dam and Appurtenances

2.4.1 Embankment - The embankment is 450' long and 47.5' high with a crest width of 18'. The upstream and downstream slopes are 3.2H:1V and 3.0H:1V respectively. The crest of the dam is straight with variations in elevation from 891.0' to 893.1' msl.

The embankment is underlain with cherty limestone of Fort Payne formations. Beneath this is Chattanooga shale and finally Ordovician age limestone.

According to District Conservationist Paul Goforth, a cutoff trench was excavated to impervious Chattanooga Shale. The design plans specify depths of

excavation between 820' and 830' msl for approximately 170' along the centerline of the dam. The trench was designed to have a base width of 10' and side slopes of 1:1.

According to Mr. Goforth, grouting was performed along the centerline of the dam. Additional grouting was done parallel to the centerline at intervals of 12', 50', and 100' both upstream and downstream of the centerline. At the upstream right of the emergency spillway critical section, a large cavern was grouted.

The general contractor, Pat Eather. of Carthage, confirmed that the rockfill toe was built to specifications; approximately 25' thick and 90' long beginning 14' upstream of the impact basin.

- 2.4.2 Service Spillway The principal spillway consists of a reinforced concrete riser 28' tall with inside dimensions of 2.5' x 7.5' and a 30" AWWA C-30l steel cylinder concrete pressure pipe 304' long. The culvert lies on a 1.6% grade and discharges into an impact basin with baffle slab and end sill. Water discharges from the basin into a riprapped channel extending 40' downstream before tieing into the natural channel. The culvert design includes eight 11½' x 7 3/4' anti-seep collars. The spillway is located almost perpendicular to the dam, left of mid-section. It maintains normal pool elevation at 871.5 msl (see photo nos. 7,8,9, and 10).
- 2.4.3 Emergency Spillway The emergency spillway is an uncontrolled earth and rock saddle type channel located at the left abutment. Its crest is protected by a narrow concrete grout cap extending most of the channel width (see photo nos. 1 and 12). The spillway is trapezoidal with a base width of 72'. The entrance and exit channels are sloped 2.6% and 2.9% respectively. The channel centerline is a regular curve perpendicular to the dam at its critical section ( see photo nos. 1 and 12).
- 2.4.4 Drawdown Facilities The reservoir is drained by means of a 24" formed concrete inlet pipe at the upstream base of the riser. It is controlled by a 24" gate valve manually operated from the top of the riser.

- Downstream Channel The natural channel lies on a slope of approximately 1.5% and has a top width of 22' at the outlet structure. Several feet downstream of the riprapped section, the channel has a 3' base width, a 20' top width, and side slopes of approximately 2H:1V. Approximately 100' further downstream, the natural channel becomes narrower with steeper slopes. It is relatively free of undesirable vegetation and other obstructions (see photo nos. 16 and 17).
- Reservoir and Drainage Area At normal pool elevation 871.5, the reservoir impounds 54 acre-feet of water in a 5.4 acre lake. At the top of the dam (elevation 891.0) the storage capacity increases to 241 acre-feet with a pool area of 15.5 acres. The average ground slope for the drainage area is approximately 11%. Major soil types in the watershed include Mountview, Frankstown, and Bodine. The land usage of the area consists of row crop farming, grassed pastureland, woodlands, and some houses (Appendix F).

#### SECTION 3 - FINDINGS

# 3.1 Visual Inspection

3.1.1 Embankment - The crest and embankment slopes are regular and well defined. They support a thick uniform grass cover over most of the dam surface. The embankment is virtually free of trees and any other deleterious vegetation or debris.

Erosion is minor. The downstream right abutment tie-in has channeled runoff water creating a shallow gully from crest to toe. Some localized rilling appears sporadically along the slope, but no significant loss of cover accompanies the condition. Seepage is nonexistant.

No cracking, sliding, or differential settlement, was observed on the embankment or in the area immediately downstream.

- 3.1.2 Service Spillway The principal spillway appears to be in excellent condition. The riser shows no signs of weathering or cracking. Similarly, the pipe outfall is free of any noticeable weathering. The baffle wall, apron, and end sill of the impact basin are all intact and in good condition. No significant erosion of the underlying and adjacent fill material was observed. There was a nominal flow eminating from the outlet, presumably the result of leakage around the headgate.
- 3.1.3 Emergency Spillway The emergency spillway channel is uniform and well defined. It is well grassed and free of any undesirable vegetation or debris. There are sporadic outcroppings of smooth flat rock along the base of the spillway, particularly near the critical section.
- 3.1.4 Drawdown Facilities The drawdown drain condition cannot be ascertained since the reservoir contains water. A deep water release duct surrounds most of the drawdown control rod, so only a small portion of the mechanism is visible. It is assumed to be operable.
- 3.1.5 Downstream Channel The downstream channel is relatively clear and free from obstruction. It

lies on a moderate 1.2 - 1.5% slope and has gently sloping sides. There is only scant vegetative cover, but no significant erosion was observed. Apparently only nominal flow has been carried by the channel in recent years (see photo nos. 16 & 17).

3.2 Review of Data - The data available for review consists of the SCS work plan for the watershed and a set of design drawings. An excerpt from the work plan section on physical data reads as follows:

The Red Boiling Springs Watershed lies in the Highland Rim area of Tennessee. The topography of the watershed is steep to rolling with variable ridge elevations on either side. Elevations around the rim of the watershed area range from about 900 to 1,035 feet above sea level. Salt Lick Creek confluences with Long Hungry Creek at elevation 708 msl.

The climate is excellent all year with an average annual temperature of 56 degrees that range from an average low of 34 in January to an average high of 80 in July. Normal annual precipitation is about 58 inches. Rains are heaviest in the late winter or early spring and the driest season is mid-fall. There are about 125 days throughout the year with measurable precipitation. Clear skies prevail on about 145 days during the year. The relative humidity averages about 70 percent. Nights are cool during the hot summer season.

The watershed is on the Northern Highland Rim physiographic province of Tennessee. The area consists of narrow "V"-shaped valleys with steep hills and ridges. The ridgetops are remnants of the Highland Rim peneplain and are supported by residual chert of the Fort Payne Formation. This formation is predominantly a cherty limestone but contains layers of calcareous siltstone and shale. Green calcareous shale interbedded with crinoidal limestone is present locally near the base of the Fort Payne.

Stream valleys have cut down through the Fort Payne along most of Salt Lick Creek and its major tributaries exposing the underlying Chattanooga shale. This formation is a black, carbonaceous shale

containing frequent nodules of pyrite. The shale is about 20 feet thick and is underlain by Ordovician limestones.

3.3 Static and Seismic Stability - The actual margin of safety for static stability cannot be determined since the engineering data required for an analytical stability analysis are not available without extensive embankment and foundation exploration. Consequently, the assessment of embankment stability must be based on visual evidence and engineering judgment. On this basis, the stability of the embankment appears to be good.

The dam is in Seismic Zone 1. No seismic stability analysis is required for the Phase I investigation, provided static conditions are satisfied and conventional safety margins exist.

3.4 Hydraulic and Hydrologic Analysis - According to OCE guidelines, the design flood for a dam in the intermediate size and high hazard categories is the PMF. Hydraulic analysis of the emergency spillway under the influence of this design storm and an antecedent moisture condition (AMC) II indicates that the dam will not be overtopped and will in fact maintain 1.9' of freeboard at maximum water surface.

#### 3.5 Conclusions and Recommendations

#### 3.5.1 Conclusions

3.5.1.1 Visual inspection of the dam reveals no indications of structural instability.

The dam appears to be well constructed, however, since it was completed only recently, it may not have had time to develop any major problems.

- 3.5.1.2 Hydraulic and hydrologic analysis indicates that the spillway is adequate to pass the Probable Maximum Flood as required by OCE guidelines for dams of intermediate size and high hazard potential.
- 3.5.1.3 The dam is located in Seismic Zone 1, indicating that the risk of damage from seismic activity is minor.

- 3.5.1.4 The dam has apparently been well maintained since construction, with no woody vegetation or debris present on the embankment or in the emergency spillway.
- 3.5.1.5 The dam is considered to have a deficiency classification of "not deficient".
- 3.5.2 Recommendations Continue a regular program of inspection, protection, operation, and maintenance.

An emergency action plan should be developed, including a warning system to alert downstream residents, in the event a serious condition develops with the project and also when the emergency spillway is expected to be used.

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#### SECTION 4 REVIEW BOARD FINDINGS

The Interagency Review Board for the National

Program of Inspection of Non-Federal Dams met in

Nashville on 10 April 1981 to examine the technical

data contained in the Phase I investigation report

for Red Boiling Springs Dam No. 1. The Review

Board considered the information and recommended that

(1) an emergency action plan be developed, including

a warning system to alert downstream residents

when the emergency spillway is in use, in the event

that a serious condition develops with the project,

and (2) the condition classification in Section 3.5.1.5;

be changed from "satisfactory" to "not deficient." They

agreed with other report conclusions and recommendations.

A copy of the letter report presented by the Review Board

is included in Appendix G.

APPENDIX A
DATA SUMMARY

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# APPENDIX A DATA SUMMARY

#### A.1 Dam

- A.1.1 Type The dam is a linear earthen structure with a saddle type earth and rock emergency spillway at the left abutment and a reinforced concrete principal spillway with a steel cylinder concrete pressure pipe culvert.
- A.1.2 Dimensions and Elevations Elevations are expressed in feet above mean sea level (msl) and are referenced to the top grating of the principal spillway impact basin. The elevation of this slab as given on the design plan is 851.0.
- a. Crest length 450'
- b. Crest width 18'
- c. Height 47.5' (measured from low point in crest to downstream principal spillway invert)
- d. Crest elevation 891.0
- e. Normal pool elevation 871.5 (from plans)
- f. Emergency spillway crest elevation 882.4 (effective)
- g. Upstream embankment slope 3.2H:1V
- h. Downstream embankment slope 3.0H:1V
- i. Size classification Intermediate
- A.1.3 Embankment Zoning The embankment design indicates that it is comprised of 8 zones including a rock toe (2 zones), an imperious core (2 zones), and peripheral sections (4 zones). Most of the earthen fill material has a high percentage of rock.
- A.1.4 Cutoffs and Grout Curtains The dam has a compacted clay cutoff trench that extends into impervious Chattanooga Shale. The axis of the dam was grouted with cement and chemical grout after the foundation excavation (see 2.4.1 Embankment).
- A.1.5 Instruemntation None

A.1.6 Operation and Maintenance - The city of Red Boiling Springs will be responsible for adequately protecting, operating, and maintaining the dam. The city will arrange with the landowners and operators for minor maintenance jobs to be done as part of regular farm operations. The major maintenance jobs will be accomplished by the city of Red Boiling Springs since this may require skilled labor or machinery normally not found on a farm.

# A.2 Reservoir and Drainage Area

- A.2.1 Reservoir
- a. At Normal Pool
  - 1) Elevation 871.5
  - 2) Surface area 5.4 acres
  - 3) Storage 54 acre-feet
  - 4) Length 1280'
- b. At Top of Dam
  - 1) Elevation 891.0
  - 2) Storage 241 acre-feet
- A.2.2 Drainage Area
- a. Size 398 acres  $(0.622 \text{ mi}^2)$
- b. Soils Mountview, Frankstown, Bodine
- c. Average slope 11%
- d. Land use Row crops, grassed pasture, woodland, some houses
- e. Runoff from PMP
  - 1) AMC II 24.7"
  - 2) AMC III 26.8"

- f. Runoff from 100 year storm
  - 1) AMC II 2.4"
  - 2) AMC III 3.6"

#### A.3 Outlet Structures

- A.3.1 Service Spillway & Drawdown Facilities
- a. Type Single stage reinforced concrete riser with AWWA C-301 steel cylinder concrete pressure pipe and 24" formed concrete drain pipe regulated by manually operated 24" sliding headgate
- b. Pipe length 304 feet
- c. Gradient 1.6%
- A.3.2 Emergency Spillway
- Type Saddle type curvilinear earth and rock channel
- b. Crest elevation 882.4 (effective)
- c. Size 72' base width
- d. Side slopes 3.1H:1V and 1.7H:1V

# A.4 Historical Data

- A.4.1 Construction date Completed October 12, 1979
- A.4.2 Engineer Soil Conservation Service
- A.4.3 Builder Pat Eatherly (Carthage, Tennessee)
- A.4.4 Owner City of Red Boiling Springs
- A.4.5 Previous Inspection None
- A.4.6 Seismic Zone 1

#### A.5 Downstream Hazard Data

The state of the second second

- A.5.1 Downstream Hazard Potential Classification
- a. Corps of Engineers High
- b. State of Tennessee 1

- A.5.2 Persons in Probable Flood Path as many as 150
- A.5.3 Downstream Property 15 to 20 family dwellings within hollow would be damaged; downstream of confluence with Spring Creek (1.1 miles downstream of dam) as many as 25 more homes may be affected. Several local roads and 1 state route downstream.

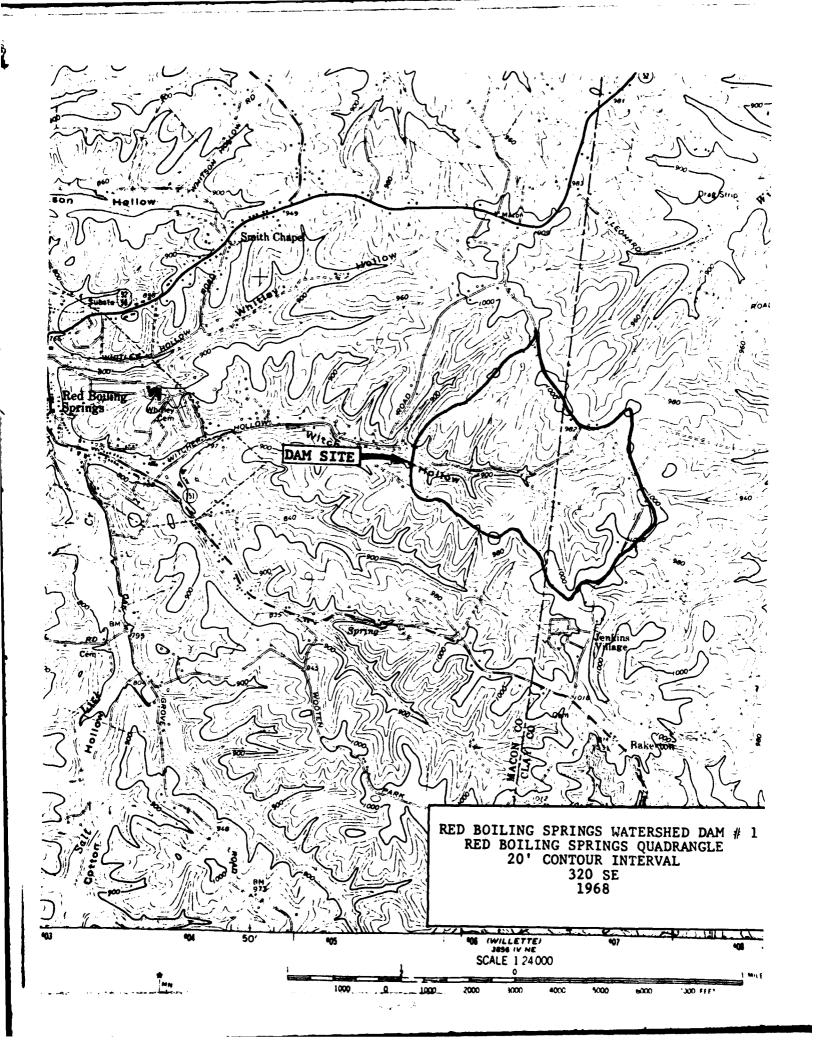
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A.5.4 Warning Systems - None

APPENDIX B
SKETCHES AND LOCATION MAPS

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RED BOILING SPRINGS DAM, NO.

DRAWN BY: MJF.
DATE: 12 JAN, 6
SHEET: 1 OF 5

GENERAL PLAN SCALE: 1"-100'

3

MAXIMUM SECTION STA. 0+00 SCALE: 1"-40

TO TOP OF PRIN. SPILL. OUTLET GRADING, ELEV. 851.0' MSL AS GIVEN NOTE: ALL ELEVS. REFERENCED ON DESIGN DRAWINGS.

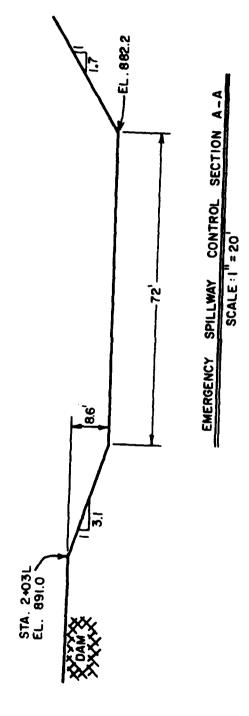
RED BOILING SPRINGS DAM NO.

DRAWN BY: G.A.D. DATE: 12 JAN. 81

SHEET: 7 YF 5

RED BOILING SPRINGS DAM NO.

DRAWN BY. GA.D. DATE: 12 JAN. 81 SHEET: 30F5



NOTE: EFFECTIVE SPILLWAY CREST EL. 882.4

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£.878.13 · 2.9% EL.882.4 DAM € 2.6 % 8.878 .13. **APPROXIMATELY** 28% -

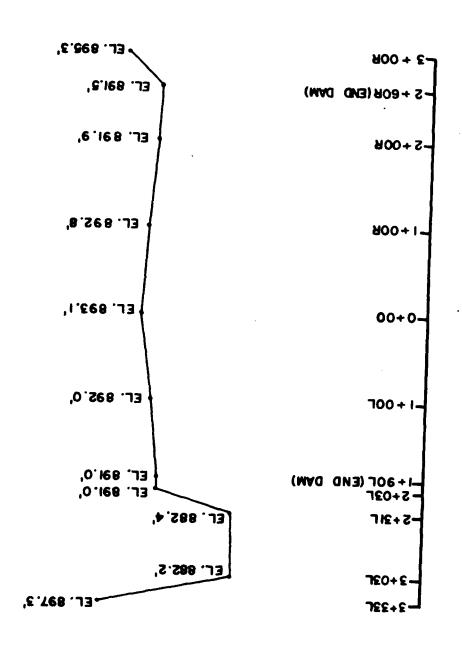
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EMERGENCY SPILLWAY PROFILE HORZ SCALE I"= 60' VERT SCALE I"= 30' RED BOILING SPRING DAM NO. 1

DATE: 12 JAN.8 SHEET: \_\_OF 5 DRAWN BY: WHC

COLLEGE TO

& PROFILE



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APPENDIX C
PHOTOGRAPHIC RECORD

#### Photo Log

Photo No. 1 - Overview from berm above emergency spillway.

Photo No. 2 - Dam crest from right side.

Photo No. 3 - Upstream face from right.

Photo No. 4 - Upstream face from left.

Photo No. 5 - Reservoir.

Photo No. 6 - Dam crest and spillway entrance channel.

Photo No. 7 - Riser.

Photo No. 8 - Riser showing low water release duct.

Photo No. 9 - Impact basin.

Photo No. 10 - Principal spillway outlet inside impact basin.

Photo No. 11 - Embankment drain outlet pipe showing some minor fines deposition.

Photo No. 12 - Emergency spillway crest showing grout cap, looking downstream.

Photo No. 13 - Minor erosion along right downstream abutment.

Photo No. 14 - View from end of emergency spillway exit channel.

Photo No. 15 - Home downstream of dam.

Photo No. 16 - Looking downstream from crest at mid-section.

Photo No. 17 - View of natural channel just downstream of dam.

Photo No. 18 - Monument plaque.

Photo Nos. 19 & 20 - Aerial shots.

NOTE: All photographs containing snow were taken on the date of the inspection. Aerial shots were taken on April 21, 1981. All others were taken as part of the pre-inspection reconnaissance, December 30, 1980.



PHOTO NO.1

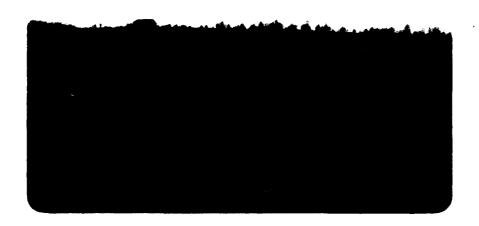


PHOTO NO.2



PHOTO NO.3.



PHOTO NO.4



PHOTO NO.5



PHOTO NO.6

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PHOTO NO.7

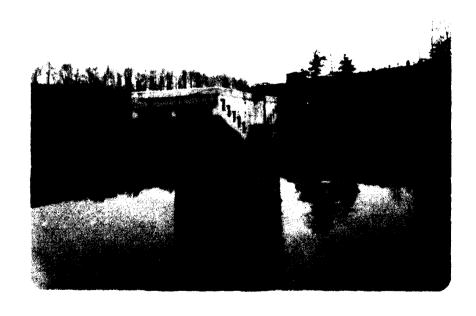


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PHOTO NO.11

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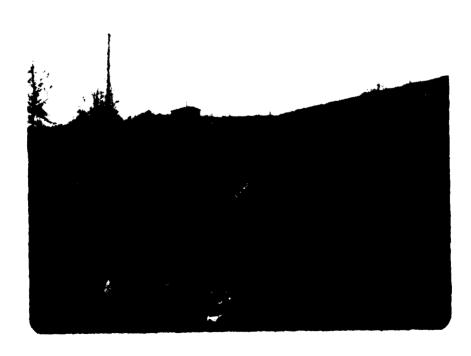


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PHOTO NO.15

PHOTO NO. 16



PHOTO NO. 17

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PHOTO NO.18

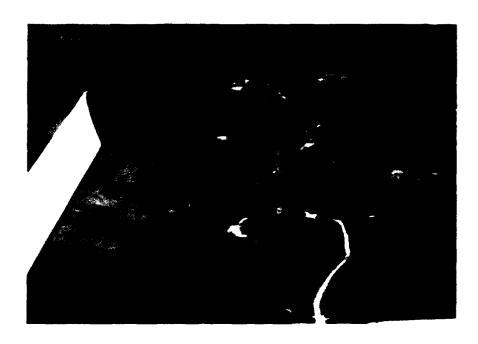


PHOTO NO.19



PHOTO NO.20

APPENDIX D

TECHNICAL CRITQUE 
CHECKLISTS FOR VISUAL INSPECTION,

ENGINEERING DATA, SOIL TESTS

## Check List Visual Inspection of Earth Dams Department of Conservation Division of Water Resources

Name of Dam Red Boiling Springs Dam No. 1
County Macon Date of Inspection January 8 1981
ID # - State 56-7004   Federal   TN 11104
Type of Dam Earth
Hazard Category-Federal High State 1
Weather Cloudy, cold, on ground Temperature 25° F
Pool at Time of Inspection Approx. 25' (distance from crest)
Tailwater at Time of Inspection tenths (distance from stream bed)
Design/As Built Drawings Available: Yes X No
Location: SCS - Nashville
Copy Obtained: Yes X No
Reviewed: Yes X No
Construction History Available: Yes X No
Location: SCS + Nashville, Watershed District Board
Copy Obtained: Yes No
Reviewed: Yes No
Other Records and Reports Available: Yes No X
Location:
Copy Obtained: Yes No
Reviewed: Yes No
Prior Incidents or Failures: Yes No X
Inspection Personnel and Affiliation:
Ed O'Neill - TDWR Al Dunn - Corps of Engineers
Bob Ramsey - TDWR Paul Goforth - SCS District Conservationist (Cookeville)
Bill Culbert - TDWR

#### I. Embankment

#### A. Crest

		Description (1st inspection)	6" gravel cover on
		crest. Some snow cover .	No differential settlement
	1.	Longitudinal Alignment Lin	near
	2.	Longitudinal Surface Cracks _	None
	3.	Transverse Surface Cracks	None
	4.	General Condition of Surface	Good.
	5.	Miscellaneous	
в.	Ups	tream Slope	
	1.	Undesirable Growth or Debris	None

way	crown vetch with winter wheat intersperced. 12 for the berm at normal pool.  Condition of Riprap N/A
<b>b.</b>	Durability of Individual Stones N/A
c.	Adequacy of Slope Protection Against Waves and Runoff Adequate

c.

Bulges or Non-Uniformity	None
	none
Surface Cracks on Face of	Slope None
Surface Cracks or Evidence	e of Heaving at
Embankment Toe None	
let or Saturated Areas or	Other Evidence of Seep
on Face of Slope; Evidence	-
	-
on Face of Slope; Evidence	-
Wet or Saturated Areas or on Face of Slope; Evidence None  Drainage System Rockfil	e of "Piping" or "Boils
None  Drainage System Rockfil	e of "Piping" or "Boils
None  Prainage System Rockfil	e of "Piping" or "Boils  I drainage system at to  Structure Good, No
None  Prainage System Rockfil  Fill Contact with Outlet erosion. Drains around e	e of "Piping" or "Boils  Il drainage system at to  Structure Good. No  endwall and stilling bas
None  Orainage System Rockfil	Structure Good. No endwall and stilling bas

D. A	P	ut	Ð	e	n	t	8
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•	Erosion of Contact of Embankment with Abutment from
	Surface Water Runoff, Upstream or Downstream
	Small gully at right downstream slope from surface
	runoff. Not serious.
•	Springs or Indications of Seepage Along Contact of
	Embankment with the Abutments None
•	Springs or Indications of Seepage in Areas a Short
•	Springs or Indications of Seepage in Areas a Short Distance Downstream of Embankment - Abutment Tie-in

\* •

•	Localized Subsidence, Depressions, Sinkholes, Etc.  None
١.	Evidence of "Piping", "Boils", or "Seepage"
•	Unusual Presence of Lush Growth, such as Swamp  Grass, etc. None
•	Unusual Muddy Water in Downstream Channel None
,	Sloughing or Erosion Slight erosion of downstream channel.
	Surface Cracks or Evidence of Heaving Beyond  Embankment ToeNone
	Stability of Channel Sideslopes Fair

-

iscellaneous _	
-	elief Wells, Drains, and Other
ppurtenances _	N/A
nusual Increas	se or Decrease in Discharge from

.

II.	Ins	trumentation	
	<b>A.</b>	Monumentation/Surveys	Monument with plaque near
		toe of dam.	
	B.	Observation Wells	N/A
	c.	Weirs	N/A
	D.	Piezometers	N/A
	E.	Other	
		<del></del>	

IV.	_	illways				
	A.	Ser	vice Spillway (Service/Emergency Combination Yes No			
		1.	Intake Structure Condition Riser appears to be in			
			good condition with no noteworthy weathering.			
		2.	Outlet Structure Condition Good condition. No			
			erosion around impact basin.			
		3.	Pipe Condition Pipe outlet appears in excellent condition.			
		4.	Evidence of Leakage or Piping Some flow through pipe. May be leaking past gate.			
		5.	General Remarks Deep water intake on upstream side of riser.			
	В.	Ene	rgency Spillway			
		1.	General Condition Excellent. Uniform and well defined with thick grass cover on side slopes. Base is mostly rock with grass covered patches of earth.			
		2.	Entrance Channel Good condition, no obstructions.  A cave was grouted in this area.			
		3.	Control Section Excellent condition. Concrete			

Exit Channel	Good grass cover on slopes with rock
base.	
Vegetative/Wood	y Cover Grassed side slopes.
Other Observati	ons Orientation of emergency spill-
way is such tha	at discharge may affect house immedia

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Emergency	Drawdow	m Facilitie	es (ii	part	of se	rvice s	pil]	lway	
so state)	Part o	f service s	pillw	ay 100	cated a	t botto	n of	E	_
<del></del>	riser.	24" slide	gate	cove	ring 2	'' openi	ng.		
		erable: Yo						<del></del>	_
Were Faci:	lities O	perated Du	ring 1	nspec	tion:	Yes		No _	X
Date Faci:	lities W	ere Last U	Bed _	Gate (	closed	in 1980	to	fill	
		(Reservoir				Ly 6' be	low	norma	al

vı.	Res	ervoir
	A.	Slopes 10%
	в.	Sedimentation Low
	c.	Turbidity Low
VII.	Dra	inage Area
		Description (for hydrologic analysis)
		Grassed pasture, row crops, and woods.
	٨.	Changes in Land Use None expected.

Å.	None				
B.	Slopes 1.5% channel				
	·				
c.	Approximate No. Homes, Population, and Distance D/S  Numerous houses downstream of dam. One house				
	immediately downstream. Two hotels.				
D.	Other Hazards Statehighway and several county roads				

	ts/Failure						
near c grout	uction with enterline, curtain.	12½ fee	apart	plus	upstream	and dov	wnstr
Cbserve	d Geology	of Area	Fort I	ayne F	ormation	. Most	of d
is com	orised of	gravely s	soil.	·····			<del></del>
Conclus	ions			<del> </del>			
Dam is	in excelle	ent cond	ition.	<del></del>			
				<del> </del>		······································	
Recomme	ndations						
	ndations	ar progra	am of pi	otection	on and m	aintenar	nce.
		ar progra	am of pi	rotectio	on and ma	aintena	nce.
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		ar progra	am of pi	rotectio	on and ma	aintenar	nce.

### OHIO RIVER DIVISION, NASHVILLE DISTRICT SOIL TEST DATA SUMMARY

SAMPLE NO.	DEPTH OF SAMPLE	LABORATORY CLASSIFICATION	NAT. WATER CONT.			MECHANICA Gravel Sen		ANA
				LL	PL	*	<b>%</b>	9
1	Surface	Mottled brown sandy, gravelly CLAY	25	33	23	21	26	5
		(CL), soft, damp, organic. Gravel=Fine,						
		angular to subangular chert.						
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APPENDIX E DESIGN DRAWINGS

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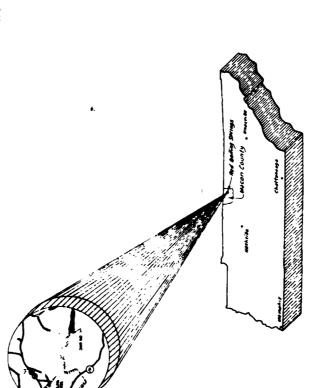
DAM NO.

# MACON AND CLAY COUNTIES, TENNESSEE RED BOILING SPRINGS WATERSHED

U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

COOPERATING WITH
CITY OF RED BOALING SPRINGS
MACON COUNTY SOIL CONSERVATION DISTRICT
CLAY COUNTY SOIL CONSERVATION DISTRICT

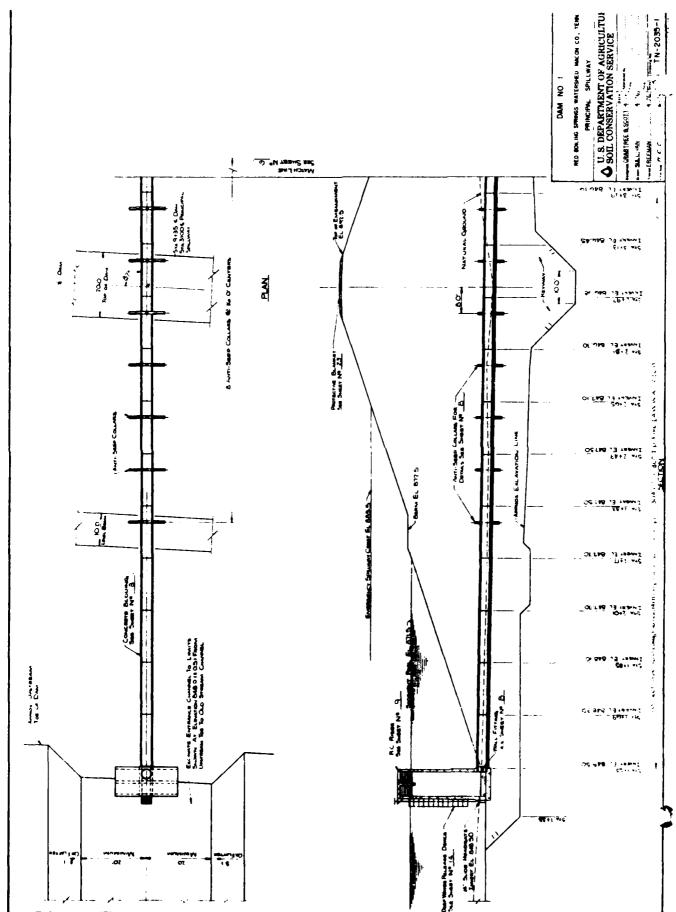
U. S DEPARTMENT OF AGRICULTURE, FOREST SERVICE

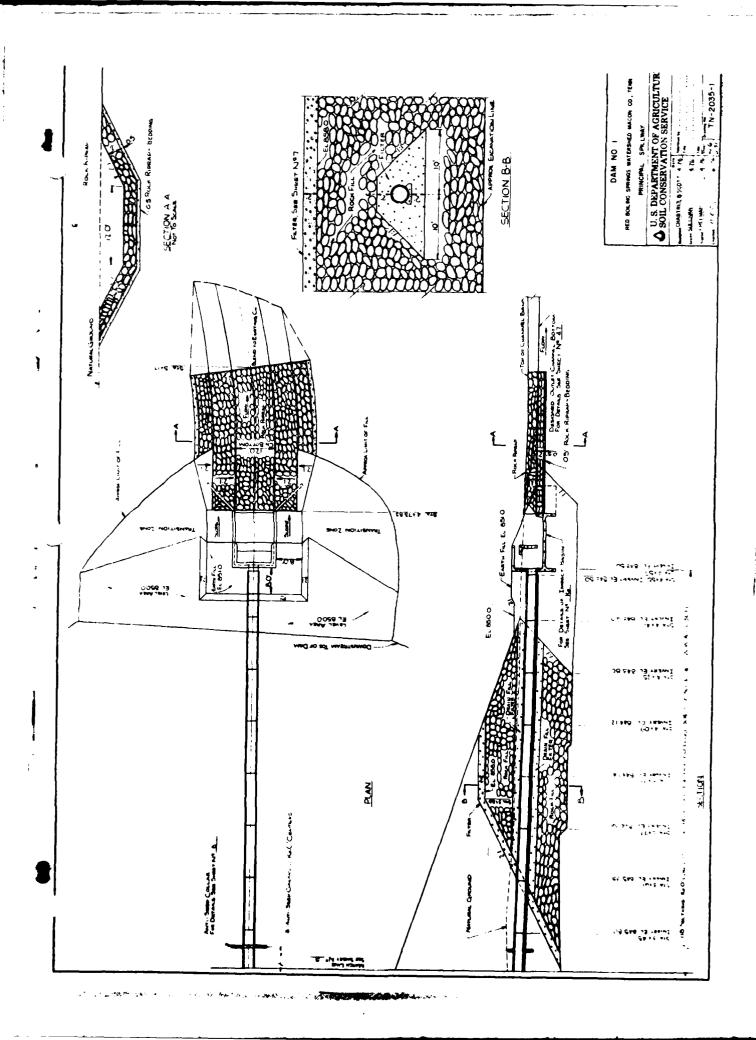


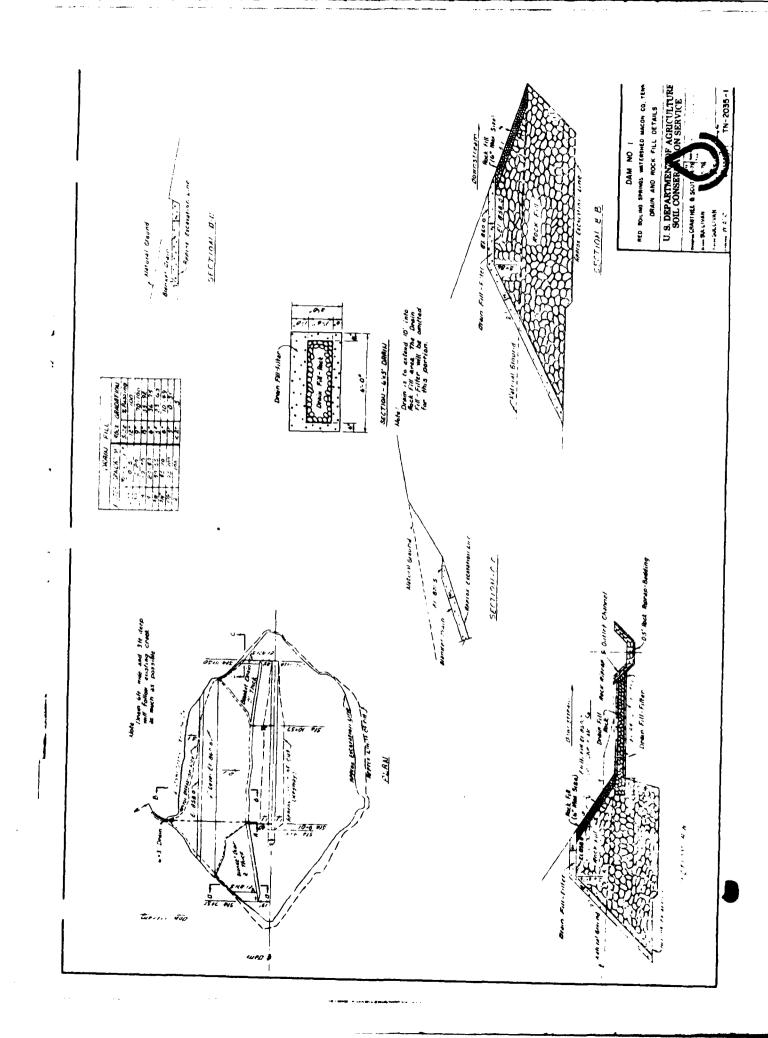
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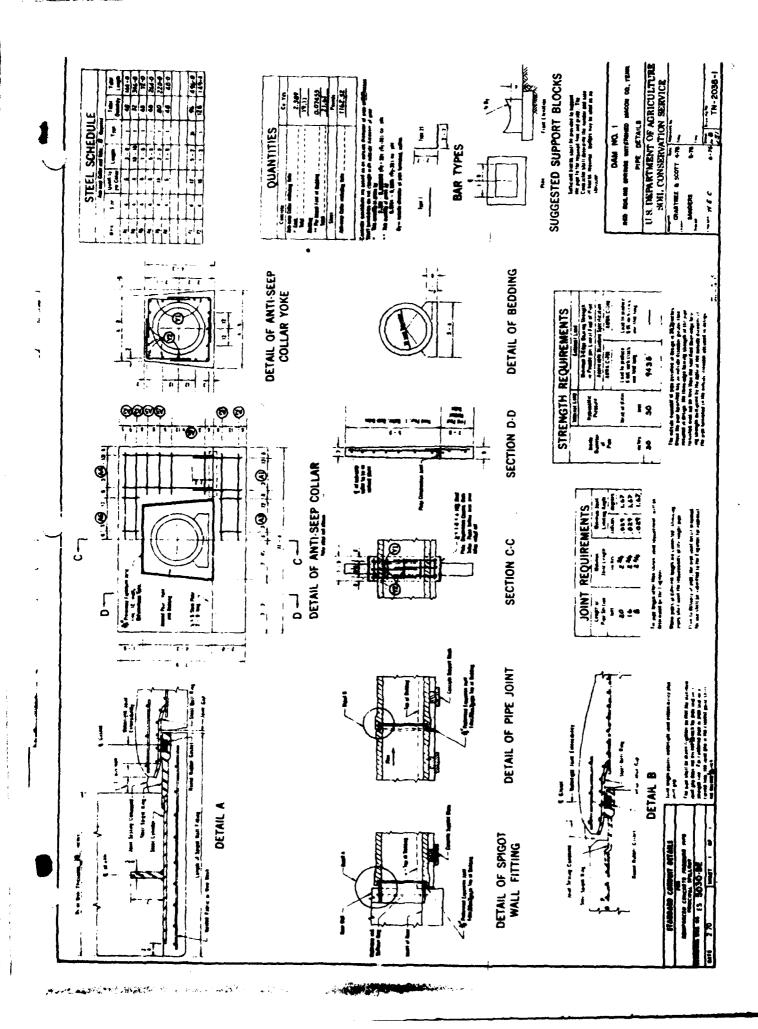
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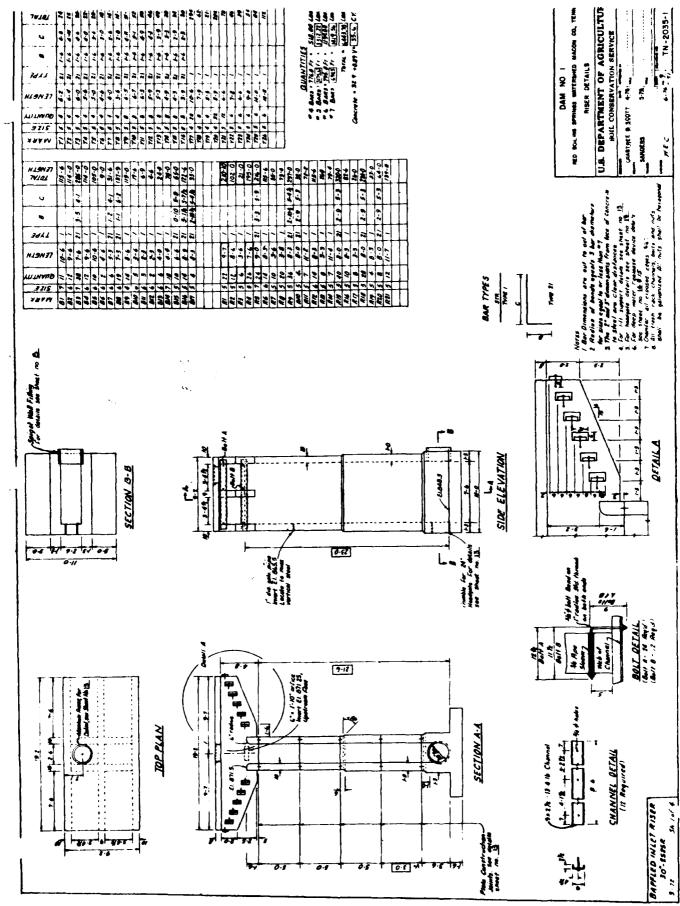
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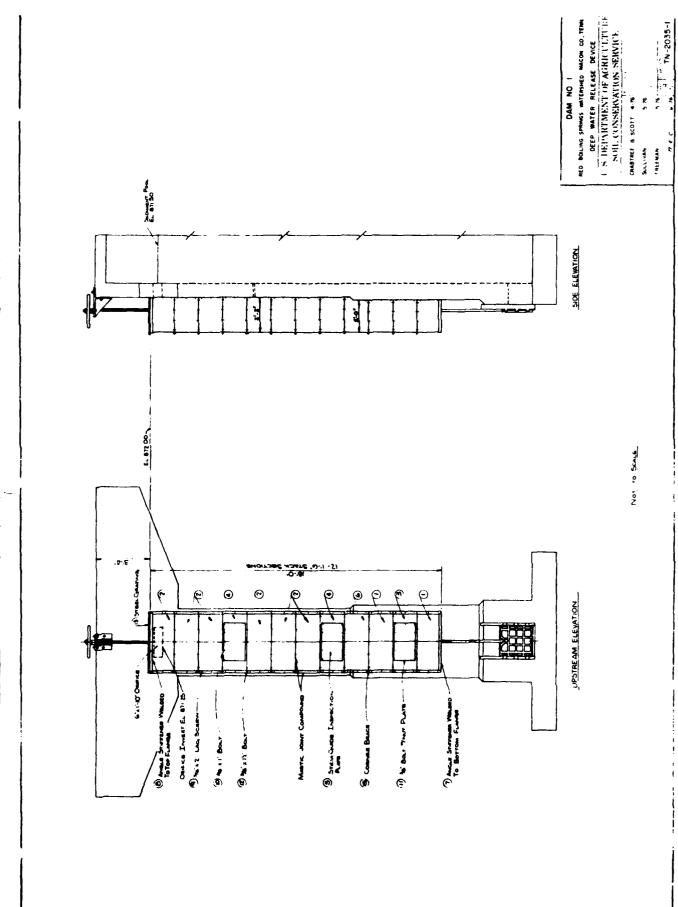
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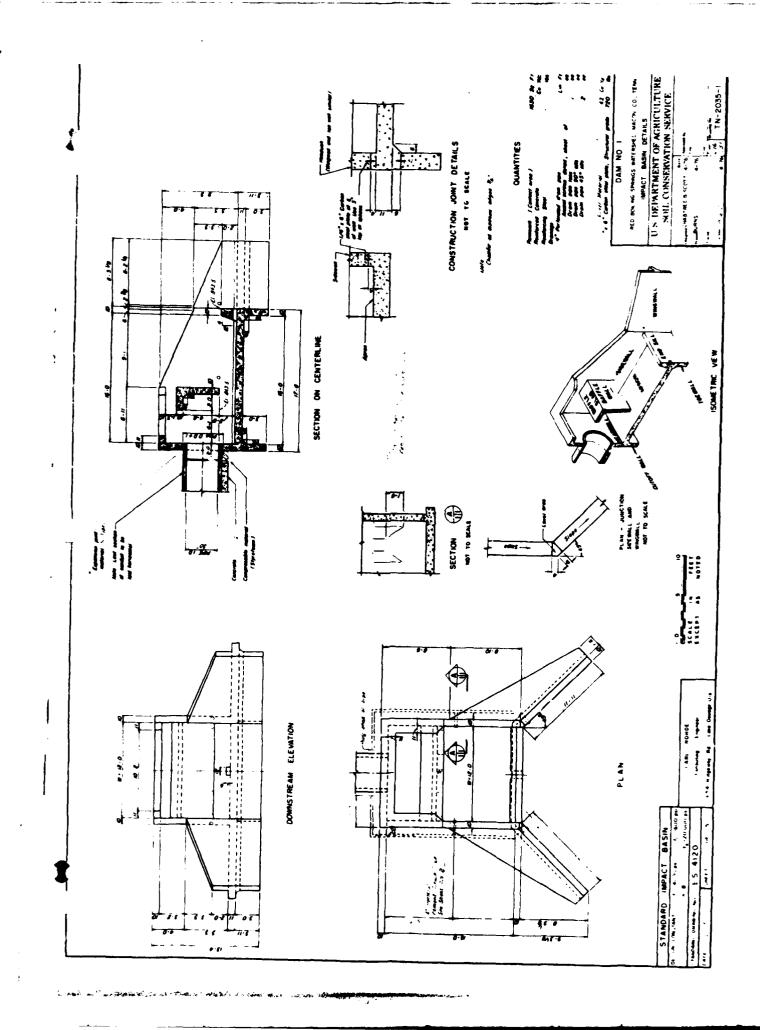
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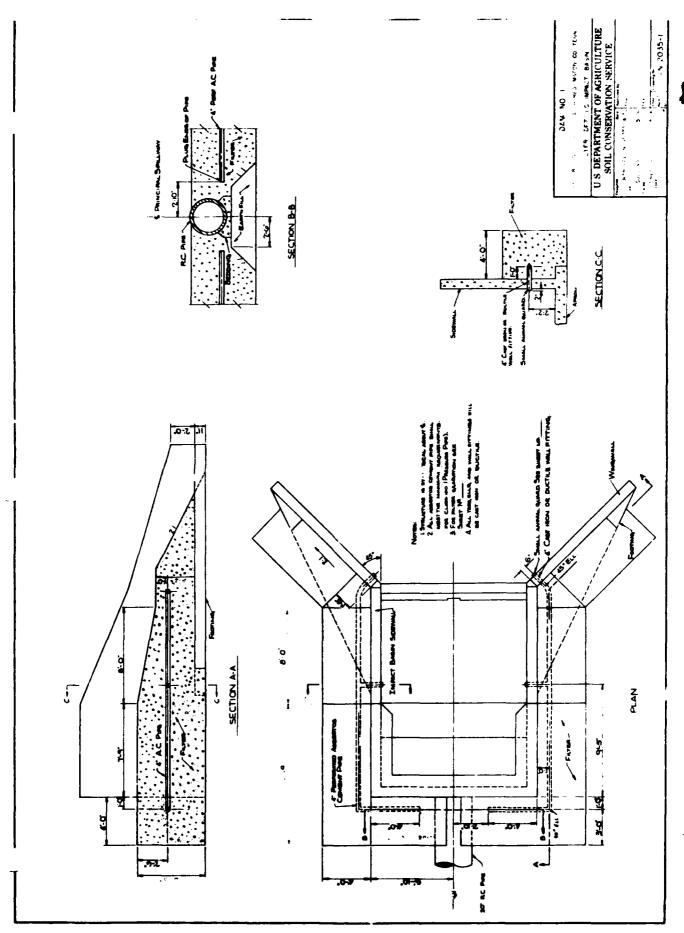
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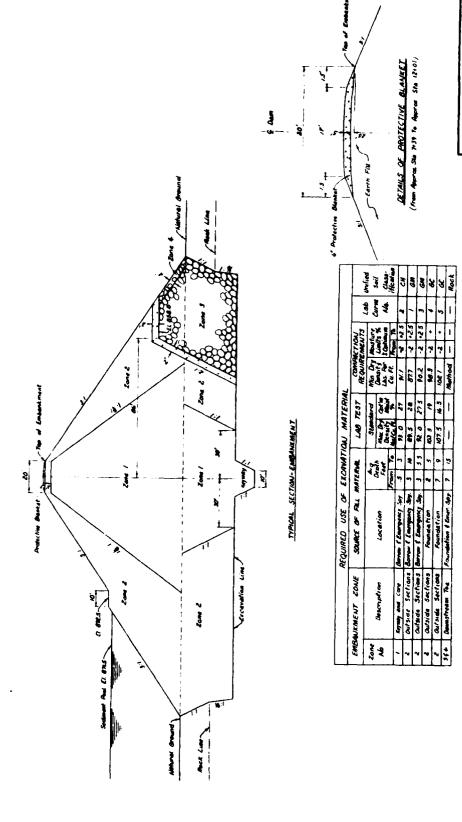
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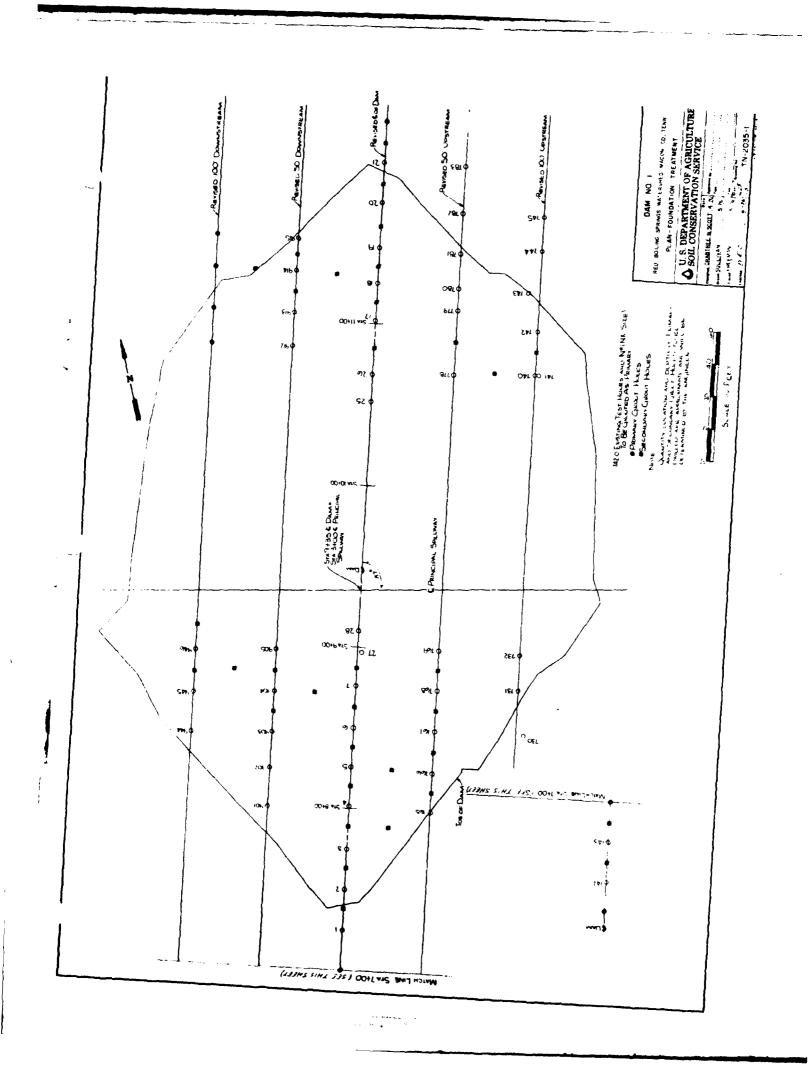
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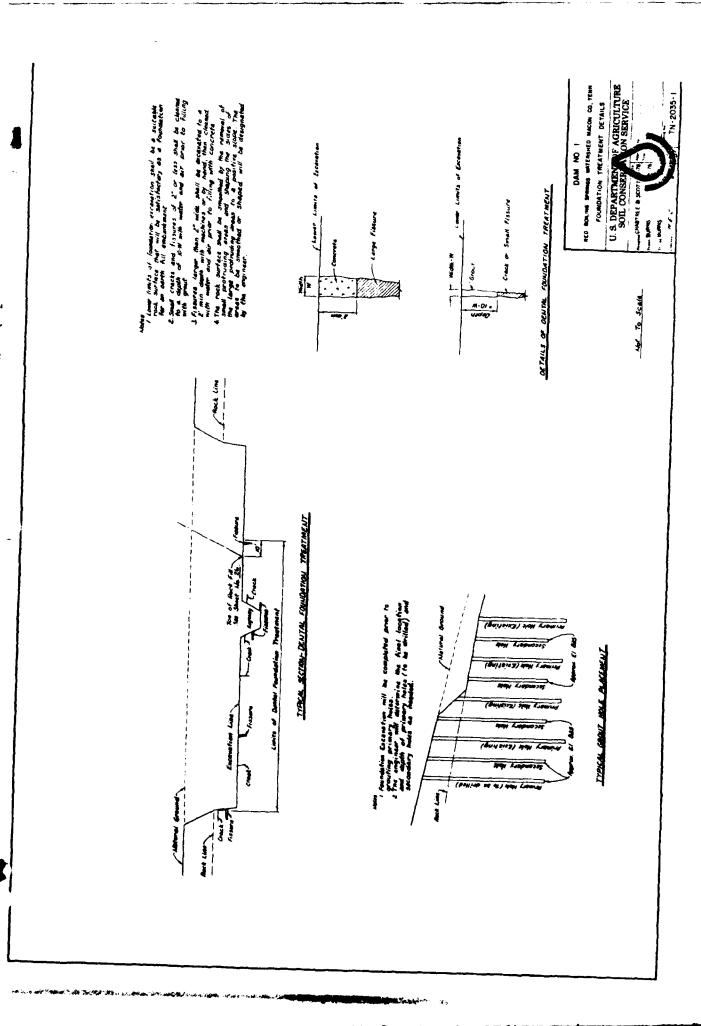
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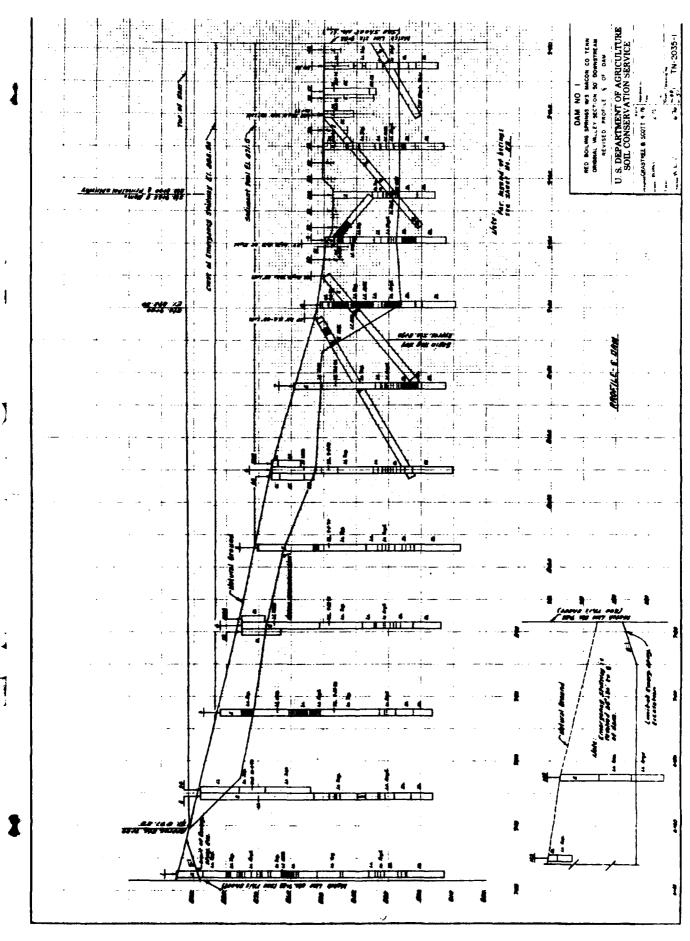


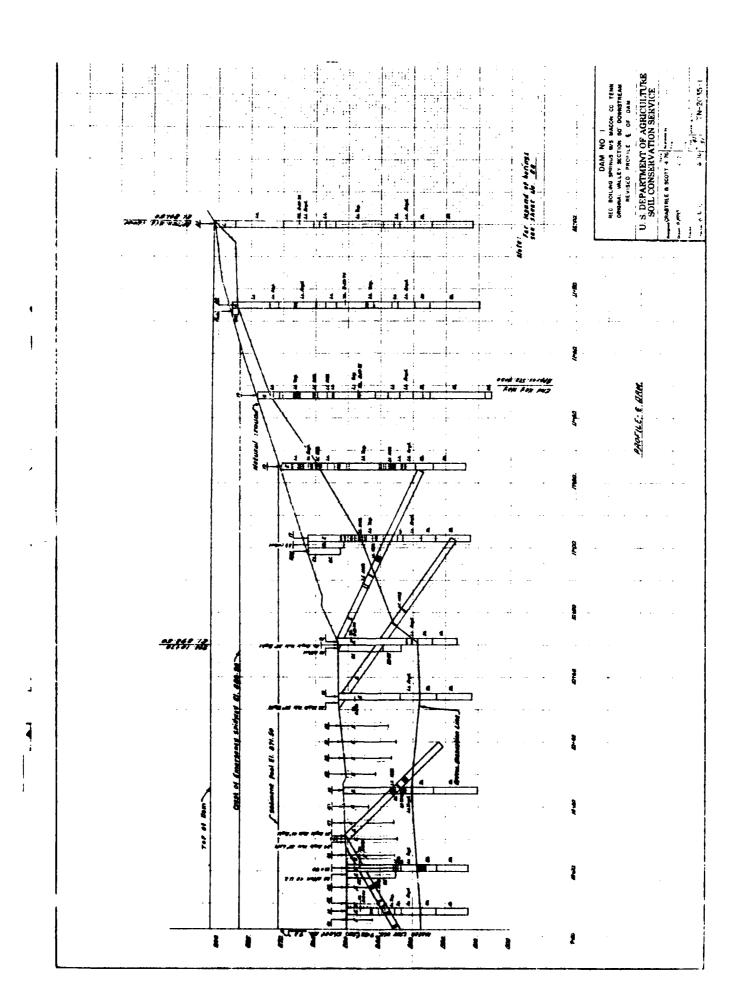
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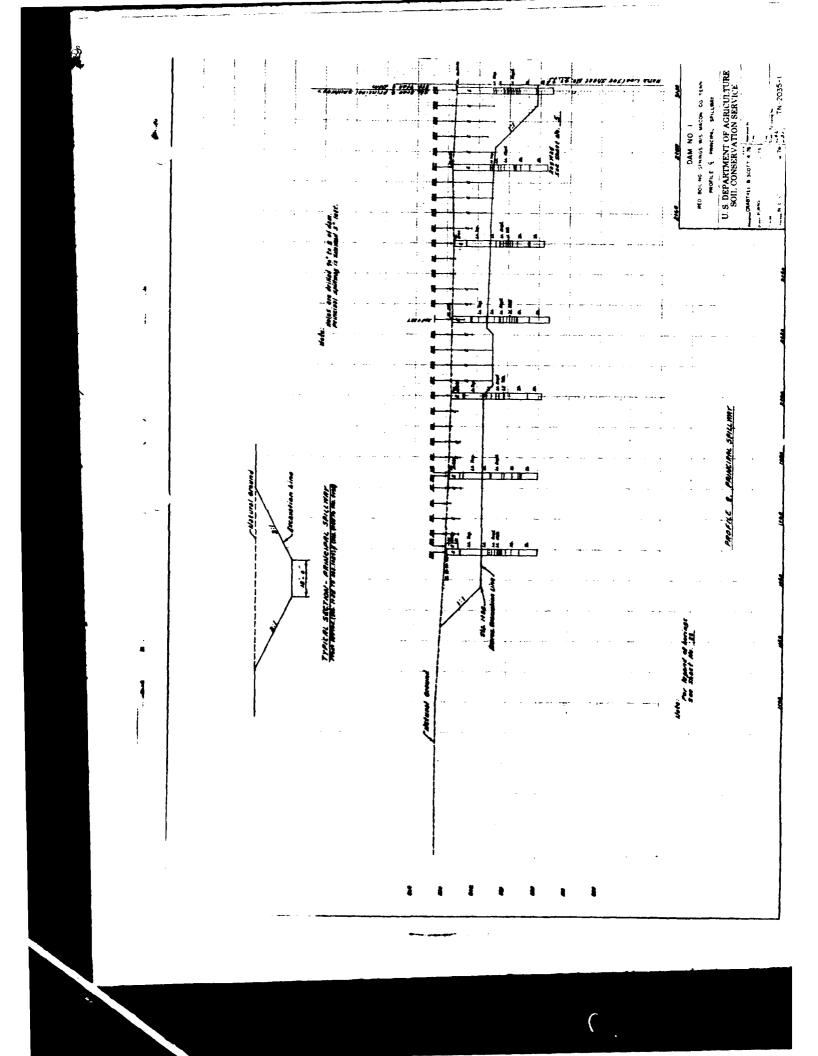
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SOIL CONSERVATION SERVICE
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CITY OF RED BOILING SPRINGS
MACON COUNTY SOIL CONSERVATION DISTRICT DAM NO CLAY COUNTY SOIL CONSERVATION DISTRICT A47 \* (+ 8 SCOTT & 76 44 108,400 CUBIC RED BOILING SPRINGS WATERSHED PROJECT U. S. DEPARTMENT OF AGRICULTURE الت القاد الساء ال EDMUND JENNINGS LAKE PREVENTION ACT SOIL CONSERVATION SERVICE Š 7 with the assistance of of the NOTE.
LOCATION OF THE MOMINENT ON THE SITE WILL BE DETERMENDED BY THE EMBINERA WATER SURFACE AREA F1000 VOLUME OF FILL TOTAL STORAGE HEIGHT OF DAM DRANAGE AREA ي. FRONT ELEVATION 8 47. 26 CONCRETE MONUMENT 17 ,09 사 5 @ 6 14 Born Ware LEFT ELEVATION 2 PLAN 9 0 1 ,4 SE , 2°, T<u>r</u>

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APPENDIX F
HYDRAULIC AND HYDROLOGIC DATA

#### HYDROLOGIC AND HYDRAULIC ANALYSIS

According to OCE guidelines, Red Boiling Springs Dam \$1 must be able to safely pass the Probable Maximum Flood (PMF). Six-hour rainfall depths for the Probable Maximum Precipitation (PMP) and the 100-year rainfall were obtained from the U. S. Weather Service's Technical Paper 40. Flood routings were performed using the HEC-1-CB computer program. The program used the dimensionless hydrograph technique described in Section 4 of the Soil Conservation Service National Engineering Handbook and the Modified Puls method of reservoir routing.

The peak outflow from the PMF (AMC II) is 4634 cfs. This flood does not overtop the dam.

#### RED BOILING SPRINGS DAM #1

#### Rainfall-Runoff Data:

Antecedent Moisture Condition II			
Storm Event	PMP	0.56 PMP	100 yr.
Duration of Storm	6 hr.	6 hr.	6 hr.
Precipitation Depth	28.2"	15.7"	4.8"
Runoff Depth -	24.7*	12.4"	2.4"
Peak Inflow to Reservoir	5044 cfs	2522 cfs	504 cfs
Maximum Flood Elevation	889.1	886.6	877.9
Antecedent Moisture Condition III			
Storm Event	PMP ·	0.52 PMP	100 yr.
Duration of Storm	6 hr.	6 hr.	6 hr.
Precipitation Depth	28.2*	14.8"	4.8"
Runoff Depth	26.8"	13.4"	3.6"
Peak Inflow to Reservoir	6328 cfs	3164 cfs	823 cfs
Maximum Flood Elevation	890.0	887.2	880.6

#### SUMMARY OF ROUTINGS

	ANTECEDENT MO	ISTURE CONDITION
EVENT	11	111
PMF	Passed with 1.9' of freeboard	Passed with 1.0' of freeboard
4 PMF	Passed with 4.4' of freeboard	Passed with 3.8' of freeboard
LOO - YEAR	Passed with 13.1' of freeboard	Passed with 10.4' of freeboard

#### FEU BOILING SPIS. WATERSHED DAM #1

#### CONTRACTOR OF TERMINATION:

6 4 10 05 E	Y OF D.A.	CN (SOIL GP. B: MICHNEVIEW,
IDLE	z 8	70 FRANKSTOWN, BOSTIE )
ST. EIN'CROPS	21	e6
umoed.	12	60
FRASSLA PASTURE	21	70
11156	16	8Z
u AFER	7	100

#### INGTIME DETERMINATION:

USING THE MORE CONSERVATIVE SCS ON METHOD

$$L = \frac{2^{\circ 8}(s+1)^{\circ .7}}{1900 \, r^{\circ .5}}$$

LE LONGEST WATER COURSE OF D.A.

Y = AVER. BASIN SLOPE

$$L = \frac{(000)^{28} (3.16 + 1)^{0.7}}{1900 (11)^{0.5}}$$

<sup>\*</sup> WITE - LAND USE DISTRIBUTION IS THAT OF THE SCS.

#### RED BOILING SPGS WATERSHED DAM # 1

#### SPILLWAY RATING CURVE DETERMINATION:

#### USING THE FOLLOWING EXPRESSION FOR FLOW AT CRITICAL DEITH:

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('MSL)	Δ <i>a</i>	COMP.	(1t)	(0/5)	(145)	(1t)	(MSL)	· + (2)
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535.5	94.0	237.6	86.4	2235	127	1.38	886.9	2362
596 4	88.B	326.4	91. 2	3502	129	1.79	88 S. Z	3631
5874	936	420.0	96.0	4982	131	2.19	889.6	5113
9864	98.4	518.4	100.8	6668	133	2.57	8 91.0	८ ३०।
339.4	103.2	621.6	105.6	8553	134	2.94	9923	E601
590.4	108.0	729.6	110.4	10,637	136	3.30	8937	10,77
3914	113.0	842.6	113.3	13,032	137	3.72	895.1	13,169
8924	113.3	955.9	113.3	15,747	139	4.22	8966	15 846
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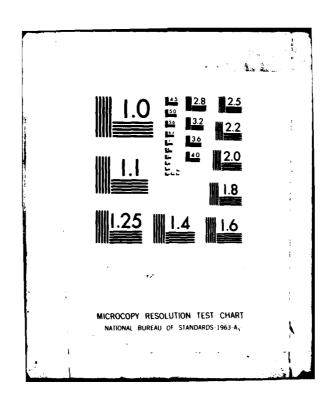
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APPENDIX G
CORRESPONDENCE



### TENNESSEE DEPARTMENT OF CONSERVATION DIVISION OF WATER RESOURCES 4721 TROUSDALE DRIVE, NASHVILLE 37220

616/741-6660

#### Certified

December 1, 1980

The Honorable Willis Knight
Mayor of Red Boiling Springs
P.O. Box 190
Red Boiling Springs, TN 37150

#### Dear Dam Owner:

As provided by the State Safe Dams Act, Tennessee Code Annotated, Sections 70-2501 to 70-2530, non-federal dams in Tennessee must be inspected and certified for safety by our agency. According to our records, you are identified as the owner of Red Boiling Spgs Dam, located in Macon County, Tennessee. Enclosed for your information and review is a copy of our inventory record on the structure along with a copy of the Act and adopted rules and regulations.

Tentative plans are to schedule a safety inspection of your dam within the next few months. A staff engineer will very shortly be in further communication with you to discuss the pending inspection and your responsibilities under the Safe Dams Act. Your immediate attention, however, is called to the matter of maintaining the earthen dam with a good grass cover and clear of all brush, undergrowth and tree growth. If these conditions do not presently exist, please make plans to remove the brush, undergrowth and all trees less than two inches in diameter as soon as possible. Larger trees may have to be removed at a later date but must be done so under the direction of an experienced engineer.

Please let me, or our Chief Engineer, Mr. Ed O'Neill, know of any assistance we might be.

Robert A. Hunt, P.E.

Very truly yours

Director, Division of Water Resources

RAH:1t

Enclosures



#### DEPARTMENT OF THE ARMY

MASHVILLE DISTRICT. CORPS OF ENGINEERS

P. O. BOX 1070

NACHVILLE TENNESSEE 27202

REPLY BEFOR TO

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NON-FEDERAL DAM INSPECTION REVIEW BOARD PO BOX 1070 NASHVILLE, TENNESSEE 37202

District Engineer, Nashville District US Army, Corps of Engineers PO Box 1070 Nashville, TN 37202

- 1. The Interagency Review Board, appointed by the District Engineer on 8 October 1980, presents the following recommendations after meeting on 10 April 1981 to consider the Phase I investigation report on Red Boiling Springs Dam No. 1 inspected by the Tennessee Department of Conservation.
- An emergency action plan should be developed, including a warning system to alert downstream residents when the emergency spillway is in use, in the event a serious condition develops with the project.
- 3. Section 3.5.1.5 should be changed to read 'The dam is considered to have a condition classification of "not deficient."'

4. The board is in agreement with report conclusions and recommendations following minor revisions.

FRANK B. COUCH

Chief, Geotechnical Branch

Chairman

EDMOND B. O'NEIKL

Alternate, Division of Water

Resources

State of Tennessee

Hydrologic Technician

Alternate, US Geological Survey

Assistant Design Engineer

Soil Conservation Service

F. PHILLIPS

Chief, Hydraulics Section

Alternate, Hydrology & Hydraulics Branch

Chief, Structural Section Alternate, Design Branch

## END

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